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During a three year period the High-Speed Digital Architecture Laboratory (HSDAL) benefited enormously from the award of two ARO Fellowships. The Fellowships were awarded to support the main-line ARO activities of the HSDAL which has been, and continues to be, high-speed computer architecture and digital signal processing. The HSDAL has, we feel, an international reputation in several sub-areas of these broad technologies. Students supported: Dr. JoEllen Wilbur, Dr. Michael Griffin, Dr. Eric Dowling, Dr. Michael Sousa, and Mr. Glenn Zelnicker.

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# ARO FINAL REPORT

## ARO AWARD DAAL03-86-G-0049

## *ARMY SCIENCE & TECHNOLOGY*

## *FELLOWSHIP PROGRAM*


**prepared by:**

**Dr. Fred J. Taylor, Director**

**High-Speed Digital Architecture Laboratory - HSDAL**

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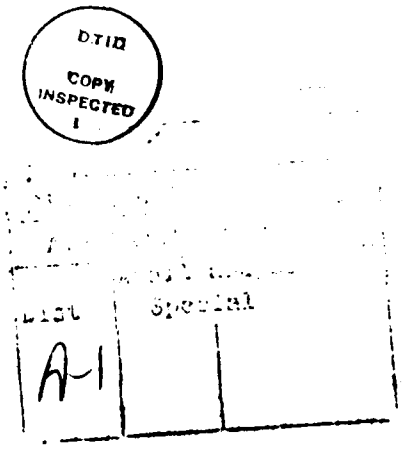


**October, 1989**

## INTRODUCTION

During a three year period the High-Speed Digital Architecture Laboratory (HSDAL) benefited enormously from the award of two ARO Fellowships. The Fellowships were awarded to support the main-line ARO activities of the HSDAL which has been, and continues to be, high-speed computer architecture and digital signal processing. The HSDAL has, we feel, an international reputation in several sub-areas of these broad technologies.

During the ARO Fellowship period, the following students were supported:

1. Dr. JoEllen Wilbur
2. Dr. Michael Griffin
3. Dr. Eric Dowling
4. Dr. Michael Sousa
5. Mr. Glenn Zelnicker

The Ph.D. track students supported under this award aggressively pursued new science and technologies. Their efforts were, in general, successful. Their individual contributions are summarized below:

Dr. JoEllen Wilbur

Status: Ph.D. awarded in 1987; Dissertation Title:

> Analysis and Implementation of the Wigner Distribution Based on Spectral Estimation Techniques for Time-Varying Signals

Dr. Fred J. Taylor, Committee Chairman

Employment Record: Clemson University (Department of Electrical and Computer Engineering), currently at Naval Costal Laboratory, Panama City, FL.

Publications:

- Consistent Speaker Identification via Wigner Smoothing Techniques, JoEllen Wilbur and F.J. Taylor, IEEE ICASSP '88, New York
- High-Performance Time-Varying Spectral Estimation, JoEllen Wilbur and F.J. Taylor, IEEE ICASSP '88, New York
- The Joint Estimation of Frequency-Rate Using the Wigner Distribution, P. Rao, J. Wilbur, and F. Taylor, in review, ICASSP '90
- Time-Varying Spectral Estimation Using the Singh Modulus RNS, J. Wilbur and F. Taylor, in review, IEEE ASSP Transactions

Dr. Michael Griffin

Status: Ph.D. awarded in 1989; Dissertation Title:

The Residue Number System, Complex Residue Number System, and Digital Signal Processing

Dr. Fred J. Taylor, Committee Chairman

Employment Record: The Athena Group Inc., currently at United Technologies, Hartford, CN.

Publications:

- A DFT Using Number Theoretic Logarithms, M. Sousa, M. Griffin, and F. Taylor, IEEE ICASSP '88, New York
- New Scaling Algorithms for the Chinese Remainder Theorem, M. Griffin and F.J. Taylor, ASILOMAR '88
- Narrowband Reduced Complexity Transform Domain Adaptive Filter, M. Griffin and F.J. Taylor, ASILOMAR '88
- A Multi-Purpose VLSI Floating-Point Array Processor, E. Dowling, M. Griffin, M. Lynch, and F. Taylor, ASILOMAR '88, November 1988
- A Residue Number System Reduced Instruction Set Computer (RISC) Concept, M. Griffin and F. Taylor, ICASSP '89, Glasgow, May 1989
- Efficient Scaling in the Residue Number System, M. Griffin, M. Sousa, and F. Taylor, ICASSP '89, Glasgow, May 1989
- An Efficient Scaling in the Residue Number System, F. Taylor, M. Sousa, and M. Griffin, in review, IEEE Trans. on Computers
- Arithmetic and Architecture Implementation Trades for Large Dynamic Range High Speed GaAs Based Digital Signal Processors, Michael Kosek, Fred J. Taylor, Michael Griffin, and David B. Chester, IEEE MILCOM, Boston, October 1989
- Turn a PC into a Supercomputer, R. Drafz, F. Taylor, M. Griffin, E. Dowling, and M. Lynch, Electronic Design, November 23, 1989.

Dr. Eric Dowling

Status: Ph.D. awarded in '89; Dissertation Title:

Systolic and Bus-Connected Arrays; Architectures, Algorithms, and Algorithm Transforms

Dr. Fred J. Taylor, Committee Chairman

Employment Record: University of Texas at Dallas, Department of Electrical and Computer Engineering.

Publications:

- Linear Algebraic Tools for the Mapping of Recurrence Algorithms to Systolic Arrays, E. Dowling (ARO Fellow), F. Taylor, and M. Sousa (ARO Fellow), revised – to IEEE Trans. on Computers
- Matrix Methods for the Design and Analysis of Multi-Purpose Arrays, E.M. Dowling and F.J. Taylor, ICASSP '89, Glasgow, May 1989
- Towards a Multi-Purpose Systolic Array, E. Dowling, N. Euliano, and F. Taylor, in review, Journal of Parallel and Distributed Computing
- Matrix Methods for the Design and Analysis of Recurrent Algorithms for Multi-Purpose Systolic Arrays, E.M. Dowling and F.J. Taylor, to IEEE Trans. on Computers

Dr. Michael Sousa

Status: Ph.D. awarded in Mathematics 1987; entered HSDAL to pursue Ph.D. in Engineering, Studies continue.

Dr. Fred J. Taylor, Committee Chairman

Employment Record: MITRE Corp, Boston, MA.

Publications:

- A DFT Using a Number Theoretic Logarithm, M. Sousa, M. Griffin, and F.J. Taylor, IEEE ICASSP '88
- Efficient Scaling in the Residue Number System, M. Griffin, M. Sousa, and F. Taylor, ICASSP '89, Glasgow, May 1989
- An Efficient CRT Implementation, F. Taylor, M. Sousa, and M. Griffin, in review, IEEE Trans. on Computers
- An Efficient CRT Implementation, F.J. Taylor and M. Sousa, to IEEE Trans. on Computers
- Linear Algebraic Tools for the Mapping of Recurrence Algorithms to Systolic Arrays, E. Dowling, F. Taylor, and M. Sousa, revised – to IEEE Trans. on Computers

Mr. Glenn Zelnicker

Status: Ph.D. track student, study in progress.

Dr. Fred J. Taylor, Committee Chairman

Employment Record: Ph.D. track student supported under and ARO research contract.

Publications:

- A VLSI Multi-Purpose RNS Chip, F. Taylor, G. Zelniker, and J. Smith, in review, ICASSP '90